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# The Effect of Practice with Digits upon the Span of Retention in Children

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THE EFFECT OF PRACTICE WITH DIGITS UPON THE SPAN OF  
RETENTION IN CHILDREN

By

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A Thesis Submitted in Partial Fulfillment of  
the Requirements for the Degree of Master  
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## CHAPTER I

### REVIEW OF THE LITERATURE

The statement "practice makes perfect" is a commonplace one. This is especially the case where school work with children is concerned. However, there are individuals who take exception to the statement "practice makes perfect." Their objection to this adage is based upon the observable fact that in many cases where practice is sustained, the outcome of the practice could by no criteria be said to be "perfect." Many objectors to the adage would substitute the phrase "practice makes permanent." Here again, there are questions raised concerning span of retention which may or may not be affected by practice.

Before indicating the scope and nature of the present experiment which is an attempt to study possible diverse effects of practice upon retention in children, a review of some of the literature in this field is presented.

Despite the volumes of research that have been conducted and described in the field of the psychology of learning surprisingly little research has been done concerning the effect of practice with digits upon the span of retention in children of elementary school age. However, the writer will attempt to present a review of the literature which in her opinion most closely focuses upon the research described in the present study.

As one reviews the literature it appears that perhaps Ebbinghaus' work with the learning of nonsense syllables should be mentioned as an early

contributing study. Ebbinghaus, in experimenting with nonsense syllables and stanzas of poetry as mediums of learning, found that his subjects utilized much less energy in learning materials which were meaningful such as poetry than they did in learning unmeaningful materials such as nonsense syllables.

William James, also, made pioneer attempts in the field of memory. His concern was whether or not a subject's native memory ability is affected by practice. His experimental results, now widely known, indicated that he believed that upon the basis of these results, practice had little or no effect upon the subject's innate memory capacity.

In the years following James's experimentation, most of the studies in the field of learning which were concerned with the span of retention were primarily concerned with only certain factors. The studies dealing with some of these factors will now be discussed briefly.

One might mention foremost, for purposes of this presentation, those studies which had as their primary concern the problem of whether the fast learner is the better retainer. An illustration of such a study is that done by Annette L. Gillette on "Learning and Retention."<sup>1</sup> This study was a comparison of three experimental procedures investigating the problem of whether the fast learner is the better learner. Her investigation, like so many others of this type, proved to be inconclusive.

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1 A. L. Gillette "Learning and Retention." Archives of Psychology, 28, 1936, No. 198

The literature is replete with studies concerning the capacity of retention in children of elementary school age during vacation time. R. C. Cook's study done in 1943 is an example of the general type of this study.<sup>2</sup> Cook worked with children in the first two grades. He arranged to have them given reading and arithmetic workbooks to take home during the summer. They were to spend fifteen minutes a day during the summer practicing in these workbooks. Upon being given a re-test in the September term the results of the retests showed that there was a rapid rate of forgetting during the vacation period. Cook's conclusion was in agreement with the results found in other similar studies. It is also interesting to note the report of Cook that the more time children spent in study during the summer vacation the more they remembered for the September retest.

During the years 1941 to 1948 many studies were done on the relation of speed of learning to the amount retained. H. J. Leavitt did such a study with groups of subjects.<sup>3</sup> He used four groups of subjects with twelve persons in each group. They were given ten, thirty second trials to learn a list of fifteen nonsense syllables, and also a similar ten trial session on a pursuit motor. After one, seven, twenty-eight, and seventy day periods, the retention of each type of material was retested. According to Leavitt's conclusions, the fast learners showed the greatest absolute amount of retention and also

2 R. C. Cook "The Study of Vacation Retention of Fundamentals by Primary Grade Children," Elementary School Journal, 1943, Vol. 43, pp. 214-219.

3 H. J. Leavitt "The Relation of Speed of Learning to Amount Retained and to Reminiscence," Journal of Experimental Psychology, 1945, Vol. 35, pp. 134-140.

the greatest amount of retention with reference to the original scores. As the retention interval increased, the rank order correlations between the amount learned and the amount retained changed from a positive to a negative correlation for both the nonsense syllables and the pursuit motor.

More closely related, however, to the research presented in the writer's study is that done by M. E. Hamilton in 1943.<sup>4</sup> Hamilton worked with fifth grade children on the learning of three different tasks. These tasks were: artificial language, symbol digit, and 'making gates' routines. Each one of the fifth graders was given twenty trials on each of the three routines. Each one of the trials was applied to a separate group which had had a specified amount of practice. These were matched with identical groups in pertinent respects with the exception of the practice period. Some of the findings of the study were: The larger the mean score differences between groups (found in the early stages of learning) the greater was the proportion of variability because of practice. Differences in practice opportunities increased variability in results of practice until the learning curves began to smooth. Says Hamilton: "The weight of the evidence points to the importance of practice difference as a cause of variability contrary to Thorndike's claim that practice or experience differences play a minor role."

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4 M. E. Hamilton "The Contribution of Practice Differences to Group Variability" Arch. Psy. New York, 1943, No. 278, p. 40.

Perhaps the studies referred to the most often in the writer's quest for related studies were those done by Gates and Taylor<sup>5</sup> in 1925 and that of Woodrow<sup>6</sup> in 1927. These will be reviewed here because of their apparent impact upon the present subject matter.

Gates and Taylor worked with children in two separate kindergartens. In each group there were sixteen children. One of the groups was given practice periods with digits. The other group received no practice. After a period of approximately four months, the group which had the benefit of practice far exceeded the other. As a matter of fact, the non-control group exceeded the control group by an amount that equaled four years of average growth as measured by the Stanford Binet test. After approximately four more months of non-practice for both groups the original practice group was at approximately the same attainment level as was the non practice group. In other words, the results of practice had apparently been nil. The last part of the Gates and Taylor study included giving the original control group twenty-two days of additional practice not given to the non-practice group. This was done in an attempt to see whether the results of the earlier original increased attainments in learning would benefit the control group in this twenty-two

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5 A. I. Gates and G. Taylor "An Experimental Study of the Nature of Improvement Resulting from Practice in a Mental Function." Journal of Educational Psychology, Vol. 16, pp. 583-592.

6 H. Woodrow "The Effect of the Type of Training on Transference." Journal of Educational Psychology, Vol. 18, pp. 159-172.

day practice period. Such was not the case, however. The experimental or non-practice group and the practice group made the same gains as a result of the latter part of the experimental arrangement. Gates and Taylor concluded that practice was of no aid in improving memory.

Woodrow did a study entitled, "The Effect of the Type of Training on Transference" in which he divided a group of one hundred and six sophomores into three categories: 1) Those who received practice and instructions on memorizing, 2) those who received neither practice nor instruction, 3) those who received practice on memory exercises but had no help on the technique of memorizing. The first group he designated as the training group, the second group he named the control group, the third group he called the practice group. At the close of the experiment the training group did far better than the other two groups. Therefore, it was concluded that the instruction caused the improvement. However, no statement was made as to the effect of practice upon the improvement.

In 1941, an experiment was carried on by Reverend Victor Drees of Cincinnati, Ohio.<sup>7</sup> This experiment, "The Effects of Practice on Memory Performance" utilized one hundred and fifty-five sixth grade school children. He divided the youngsters into two equated groups, an experimental and a control group. The experimental group was given practice in learning how to memorize, three days a week for a period of three months. The control

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7 Victor Drees, O.F.M. The Effects of Practice on Memory Performance. Washington: Catholic University of America Press, 1941.

group did not receive any such practice. During the summer vacation of four months neither group received any practice. Upon the children's return in October, both groups were re-tested. Then, during the rest of the month of October both groups, the experimental and the control group were given special practice in memorizing. After two weeks of such practice both groups were re-tested as they were at the end of the fourth week in October. The medium used for the experiment was that of asking pupils to remember numbers by associating a number with a name. The numbers were all two-place digits. The experiment when concluded showed no improvement in actual memory ability. Drees said, however, that "The most logical explanation, the one that gives the most satisfactory answer to all the questions arising from the results of the experiment, is to say that we have reserve memory power which is not habitually used but which is called into use when we are placed under the pressure of strong motivation." (page 58) Again on page 48 of his study, Drees writes: "From this we conclude that memory practice does improve the function of memorizing, but that it has no lasting effect either in sustained improvement or in later facilitation."

Drees used children of the same grade level whose mean age was approximately twelve and a half years with an age range of ten to fifteen years.

The present writer is performing the current experiment with much younger children, at varying grade levels, in an effort to discover the

effect of practice with digits upon the span of retention in young children of various age-grade groups. She is also using methods of training calculated to sustain interest over long periods of time in the otherwise monotonous task of memorizing by rote.



## CHAPTER II

### THE PURPOSE OF THE EXPERIMENT

This experiment, unlike those discussed in the foregoing chapter has as its chief consideration the effect of practice with digits upon the span of retention in children of school age. The significance of this study arises from the various beliefs as to the value of practice upon retention and from the importance of memory span for various occupations. The conclusions to be drawn from a study such as this might indeed have vast implications in the educational order of the present day, when educational procedures are being questioned, and evaluations must be made of certain techniques in educational life. The purpose, aim, or objective of this present experiment is that of studying the effect of practice with digits upon the span of retention in children of school age. In other words, the experimenter set as a goal the solution of the following problem: Is it a fact that practice with digits has a differential effect in increasing permanently the digit span for children at different age levels.

There are three reasons which make the need for such an investigation apparent: (1) little research has been done on this particular phase of the retention problem; (2) the effect of practice with digits upon the span of retention in children has been largely ignored in clinical procedures with subjects of primary school age; and (3) the advent of the changing educational philosophy may offer new possibilities in the utilization of the possible

permanent effects of practice upon retention, with the individual child in the classroom situation.

Certain definite questions may be submitted as best presenting the purpose and value of this study:

- (1) Is there any difference in the effect of practice with digits upon the span of retention at varying age levels?
- (2) Assuming that there is more improvement with practice at one age than at another, is there any significant difference between the gains immediately after practice and those which are evident after the practice has ceased? Is there a difference in gain or loss of immediate and final retention for varying age groups of primary children?
- (3) Are the results of the data important enough to have any practical daily application?

Basic to the statement of the problem as indicated just previously is the testing of the following hypothesis: If practice has any effect upon retention, then by taking a group of school age children, equating them so that a practice and a control group are resultant, testing these groups, and carefully recording the data, the obtained data will or will not show significant differences. The data obtained will be in the form of scores. These scores will be secured from the Pre-test and Re-test which will be given to the entire group and the scores for the last day of practice for the Practice Group.

The testing of such a hypothesis has many and varied implications for both the educational world and the business world. The implications for education would be basic to the principles of learning within the classroom itself. If the span of retention can be increased through practice, then the amount of ideas and facts presented in a single hearing would not have to be held to a minimum. It would mean that small units of presentation of material could be expanded as the span of retention was increased. It would also modify that aspect of present theory which demands that for permanent learning, the teacher must go over the facts and ideas again and again. It would also mean that as the span of retention increased, the method of presentation within the classroom could be changed, thus time would be saved and utilized in other scholastic or physical endeavours. Also, both within and out of the classroom, the increase in the span of retention would be valuable from the stand-point of speed of operation.

Because of the very nature of the hypothesis upon which the problem basic to the experiment rests, it is evident that the data to be achieved in this experiment are quantitative. Other reasons for the achievement of quantitative data in this experiment were the following: Because of the method in which the experiment was designed, the greater part of the information was secured in quantitative form. For example, tests were used from which quantitative results were of necessity derived. Also one of the aims of the experiment was to study a hypothesis which could be more efficiently and effectively handled by the use of quantitative data. Qualitative data would not provide the specific results which seemed imperative. In order

that the findings of this investigation be as meaningful as possible a quantitative approach to the problem seemed to be more fruitful.

In any experimental situation variables are of prime concern. In this study the dependent variable is the score obtained upon re-test after a period of time following the practice period.

In this experimental procedure, controls had to be established for all accidental variables. Thus the problem of rigid controls for all accidental variables was carefully considered.

A judicious selection of the group had to be made in this study in order to be sure that gains due to practice were not unduly influenced by maturational or other factors. The subjects were arranged into four groupings. These groups consisted of two sections at the Kindergarten level, namely, a control group and a practice group, equated on the Pre-test for digit span; and two groups at the third grade level, namely, a control group and a practice group also equated for digit span.

After the group variable was controlled, the next variable to be considered was the procedure. In order to attain as reliable and valid results as possible, all procedures had to be made as uniform as possible. The same course was followed in the administration of all the tests. A uniform time and a planned uniform procedure was maintained throughout all practice and test situations. For purposes of this experiment, procedure took into consideration such factors as: the manner of giving the instructions to the subject; the rhythm of pronouncing the digits; the fatigue on both the part of the S and the E; the identity of the materials used throughout the entire

study; and the need for equal opportunity for practice for all of the individuals who were members of the practice group. Procedure also included certainty upon the part of the E that the S understood thoroughly all the instructional directions.

After factors relative to the group and the procedure had been decided upon, the question of a place for testing and practice had to be determined. A spacious, quiet, secluded room, which was well lighted and ventilated was secured for all the tests and practice situations. This was done in order to attain good audibility and to avoid physical fatigue as well as the possibility of any disturbances from the outside.

In this study, just as in any study of an experimental nature, uncontrollable variables were present. These uncontrollable variables were climate, health of the individuals co-operating in the study, the personal equation, the varying degrees of individual motivation, individual perservation as well as any outside influencing forces upon the individual or the total situation at any given time. These forces might include home conditions, social events, or any other daily influences which usually enter into the normal school life of every individual child.

As far as could be determined, these variables had no differential effect upon the two groups used in this study.

### CHAPTER III

#### PRELIMINARY EXPLORATION

In psychological study and in group discussion there has been a substantial amount of evidence presented as to the relative merit or lack of merit of the value of practice upon the span of retention. Many studies have been made with lists of nonsense syllables, unrelated words, and other less meaningful symbols with adults as subjects of the experimentations.

A wish to explore the possibility for performing the present experiment was prompted not only by psychological study and discussion but also by the practical wish to apply psychological theory to practice.

Among the factors involved in the exploratory stages of this experiment was the choice of subjects with whom it would be possible to carry on the experiment.

Experimentation was carried on at various grade levels with children of varying chronological ages and different social and economic backgrounds. The decision to work with the particular kindergarten and third grade children finally chosen for the experiment was based upon certain factors which became apparent in the exploratory activities. These factors were:

1. The importance of working with children in a normal school population.
2. The need to work with children who were accessible for purposes of experimentation.

3. The need to utilize children whose parents were willing to subject them to the experiment.

4. The necessity to choose groups representative of significant age differences.

5. The necessity to work with groups where the administration was cooperative.

6. The need that the school program of the subjects be flexible enough to provide time for the experimentation.

Also included in the exploratory activities was the choice of material to be used in the experiment. Thought was given to the utilization of nonsense syllables, words, alphabet letters, and related mediums. Exploration indicated that for the subjects chosen for purposes of the experiment the use of numbers would be the more meaningful, practical and interesting.

The choice of a medium of presentation was not without difficulty.

Among the factors which complicated this choice were the following:

1. The medium could not be prohibitive in terms of financial cost.

2. The medium must be possible to attain either through construction or purchase.

3. Such a medium must have interest producing and holding qualities, in view of the extreme youth of the subjects involved in the experiment.

4. The medium must be such that it could be transported,--neither too heavy, nor extremely subject to breakage.

5. Economy in terms of time was important. The operation of such a medium must not be wasteful of time on the part of either the experimenter

or subjects.

6. The medium must be devoid of extreme complexity, since this experiment was to be conducted with individuals in a group situation under the limitations of a public school situation. These limitations included time, space, administrative cooperation, and subjects' attention span, as related to the pressures of the on-going activities of the school day.

7. The medium chosen must allow for a certain amount of flexibility and readiness in view of program changes made known to the experimenter on short notice.

Among the mediums considered in exploratory activities was the activity of jumping rope to the accent of numbers. This activity seemed too arduous for the physically handicapped child or for the child of lowered vitality.

Ball bouncing was also considered. This, it was shown, did not lend itself to any accurate possible scoring method.

Bingo proved to be too exciting a stimulus to be used as a game for children of this age level.

Other games which were considered were "Rook," patented by the Rook Card Company and "Addit," sold by the Maxim Games Company of New York City. These games were undesirable because they took up too much of the subject's school day and did not provide equal maximum practice for each individual subject.

Factors which determined the final choice of a medium were the result of exploratory activities which indicated that the final choice of a hopscotch game was the game which would provide for equal practice for all



participants. Also, it allowed for the greatest amount of experimentation in the shortest amount of time thus preventing the subjects from becoming too fatigued. The game was not monotonous for children--observation of play activities shows this. This game also allowed for adequate motivation and for a control of pacing. Simplicity was the keynote of the game.

The choice of a single experimenter, in this experiment the writer, was made for the sake of attaining a maximum of uniformity in procedure and administration. The procedure decided upon for this experiment together with a description of the final choice of equipment is discussed in the ensuing chapter.

## CHAPTER IV

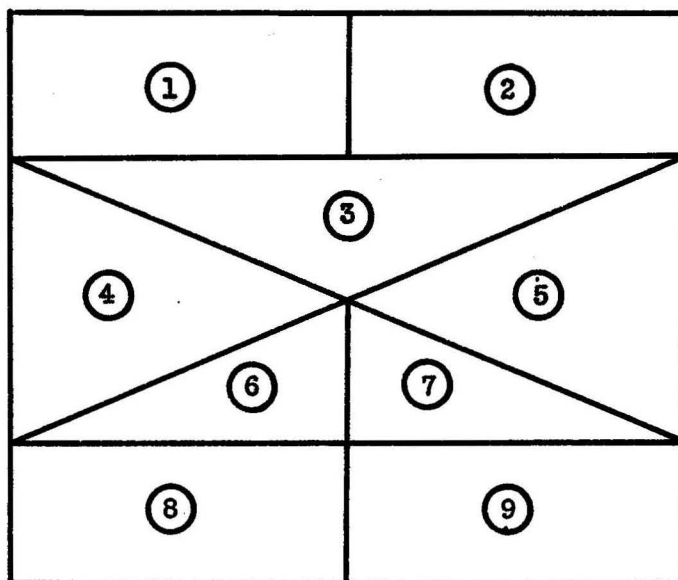
### THE PROCEDURE ADOPTED

As a result of the preliminary exploration described in the preceding chapter, a procedure was adopted and kept constant throughout the entire study. In the following paragraphs will ensue a complete description of the adopted procedure.

The materials employed in this experiment were chosen because they were simple, durable, transportable, easily duplicated for any other study of this nature, as well as being extremely well suited for the particular age level of the subjects co-operating in this present study.

The materials employed in this experiment consisted of: a very simple hopscotch board so constructed as to be portable. This board contained all the numerals from one through nine. The numerals were so arranged upon the board as to give the maximum of numerical combinations. Accompanying the hop-scotch board was a small round disc made of a light-weight plastic. A diagram of the hop-scotch board which was used appears on page 19.

Along with the above mentioned materials a stop watch, a blackboard, pencils and record blanks were utilized. Comfortable chairs for the subjects during the practice situation were all-important from the standpoint of avoiding possible physical fatigue and unnecessary distraction due to needless shifting of position, as well as eradicating to a great degree many behaviorial situations commonly resultant from physical fatigue in the



A  
DIAGRAM  
OF THE  
HOP - SCOTCH BOARD  
USED IN THIS  
STUDY

younger child.

Another important aspect of the equipment was the development and use of tests in the study. The two-fold purpose for the development and administration of tests was first, to secure a basis upon which to equate the groups and secondly, to give an objective, concrete unit of measure in order to determine the effect of practice upon retention in children of the primary level.

The following tests were presented to all subjects: the Pre-test and the Re-test. A description of both the Pre-test and the Re-test follows.

The Pre-Test was administered to all potential subjects for the study. For the purpose of administering this test, the subjects were taken individually into the testing room. The test was given to all potential subjects for the purpose of equating the groups. The S's responses were recorded immediately upon an individual score sheet. These responses were scored and tabulated. The Pre-Test was administered to thirty-four third grade children and thirty kindergarten children. As a result of the scores obtained on this Pre-test the kindergarten children were equated into a practice group and a control group. The number of subjects in each group namely, the control group and the practice group, was twelve subjects or a total of twenty-four subjects. As a result of the scores obtained on the Pre-test the third grade children were also equated into a practice group and a control group. The number of subjects in each group, namely, the control group and the practice group, was eleven subjects or a total of twenty-two subjects in the

third grade group.

The Pre-test consisted of digit series arranged in ascending order with three trials credited to each series. Series 'A' represented the two digit span, Series 'B' represented the three digit span and thus the series were increased until the eighth digit span was reached. A sample of the Pre-test will be found on page 23.

The Re-test was given to all subjects comprising both the practice and control groups for the kindergarten and the third grade. The Re-test was administered individually to each subject forty days after the Pre-test. The S's responses were recorded upon an individual score sheet. These responses were tabulated and scored subsequently. The development and construction of the Re-test was identical to the procedure described for the formulation of the Pre-test. The number of the series, as well as the number of digit spans found in each series was the same. The number of trials for each series was also the same, namely, three. The only difference was the new distribution of the digits in the Re-test. This was done so that the tests would not be identical in form. A sample of the Re-test will be found on page 24.

After the tests were administered, they had to be scored. The scoring routine for test, practice scores, and Re-test was established as follows:

1. If the subject is successful in all three trials of any one particular series, he is credited with the maximum score for the series.
2. If the subject is successful in two out of the three trials of any one particular digit series, he is credited with two thirds of that series

number, in addition to the next lower series number. For example: two correct responses for the six digit series yields a score of 5.66.

3. If the subject is successful in one out of the three trials of any one particular series, he is credited with one-third of that series number, in addition to the next lower series number.

4. If the subject is unsuccessful in all three trials of any one series, he is credited with zero for that particular series and his score is the next lower series number.

## Pre-Test

Procedure: E began the test with the following instructions:-

"I am going to give you some numbers and after I am finished, will you say the numbers just the way I did? Be sure to listen carefully." Before giving each series E said: "Listen carefully and say the numbers just the way I do." E recited the digits plainly, keeping the same tempo about one per second. There was no repetition of any set of numbers; whenever the child said he did not understand this was counted as a failure.

Series A: 6-4 3-5 7-9

Series B: 1-4-6 7-3-1 2-5-7

Series C: 3-1-4-8 9-7-3-5 6-3-7-5

Series D: 9-5-3-7-4 7-3-6-9-5 3-7-4-6-9

Series E: 5-9-6-8-7-4 7-5-3-6-4-1 3-7-4-8-6-5

Series F: 7-6-3-1-4-8-9 9-6-4-8-7-5-2 8-6-9-5-3-1-2

Series G: 6-4-1-3-5-9-7-8 6-9-5-2-3-1-4-8

2-5-7-4-3-6-8-7

## Re-Test

Procedure: E began the test with the following instructions:

"I am going to give you some numbers and after I am finished, will you say the numbers just the way I did? Be sure to listen carefully." Before giving each series E said: "Listen carefully and say the numbers just the way I do." E recited the digits plainly, keeping the same tempo about one per second. There was no repetition of any set of numbers; whenever the child said he did not understand this was counted as a failure.

Series A: 4-7 8-6 6-9

Series B: 8-7-9 7-4-3 3-7-4

Series C: 1-3-5-4 3-7-8-6 7-4-5-2

Series D: 3-5-7-9-6 4-6-8-7-9 9-5-7-3-6

Series E: 4-6-8-7-9-5 6-9-8-4-3-5 1-3-6-8-7-9

Series F: 3-7-5-2-1-4-8 2-5-9-6-7-3-1 8-6-9-7-3-5-2

Series G: 1-3-7-6-8-4-1-2 6-3-5-9-5-8-7-2 6-9-7-5-4-3-1-2



5. When any three successive trials were missed, the test was ended.

This method of scoring was used in order to secure a greater scatter of scores. It can best be illustrated by citing an example such as the following. The number of digits in the series C of the Pre-test was four. When presenting to the subject:

Pre-test Series C: 3-1-4-8 9-7-3-5 6-3-7-5

- a. If the subject gets all three trials correct, the score is four.
- b. If the subject gets two out of the three trial correct the score is 3.66.
- c. If the subject gets one out of the three trials correct the score is 3.33.
- d. If the subject gets none of the three trials correct, he gets the score for the previous series. In this particular example the score would be 3.

For convenience, this system was set up into a table termed the Score Conversion Table. This table will be found on page 23.

Thus far in the discussion little has been said about the characteristics of the group of subjects participating in the study, so it is very advisable at this point to acquaint the reader more intimately with the individuals co-operating in this study.

The group furnishing the data for this particular study consisted of forty-six children. All of these children were members of a public school

## METHOD OF CONVERTING SCORES

Number of Digit Spans Found in Each Series	Number of Trials for Each Series Correctly Repeated	Converted Score
2	2	1.66
2	3	2
3	1	2.33
3	2	2.66
3	3	3
4	1	3.33
4	2	3.66
4	3	4
5	1	4.33
5	2	4.66
5	3	5
6	1	5.33
6	2	5.66
6	3	6
7	1	6.33
7	2	6.66
7	3	7
8	1	7.33
8	2	7.66
8	3	8

population located in a large metropolitan suburb. The school was a primary school housing kindergarten, first, second and third grades. The total school population consisted of 106 persons all of whom are members of the white race. Of these 106 children in the school, forty-six participated in the experiment. These children represented an I.Q. range from 100 to 145. The mean I.Q. was 115. Twenty-four of the forty-six children were members of the kindergarten. Their age range was from five years six months to six years three months. Twenty-two of the children were members of the third grade. Their age range varied from seven years, six months to nine years, one month. None of the children had repeated a grade. All of the children came from average or better than average social and economic backgrounds. Their mothers were for the most part housewives working in their own homes. The fathers of the children were skilled laborers, business men operating a small business of their own, dentists and doctors. Approximately sixty-five percent of the children came from families owning their own homes. A very small percentage of the remaining thirty-five percent lived in apartment houses, the majority of the thirty-five percent lived in rented homes with ample play facilities. Two of the children in the group were foster children. No children in the group were from divorced parents. Four children in the group had lost one of the parents due to death. Included in the group were twenty-five boys and twenty-one girls.

As has been stated earlier in this discussion, for the purposes of this study the groups were equated on the basis of the resultant scores on the Pre-test into four groups namely: A kindergarten control group consisting

of twelve subjects, a kindergarten practice group consisting of twelve subjects and a third grade practice group consisting of eleven subjects and a third grade control group consisting of eleven subjects.

After administering the Pre-test and equating the groups the kindergarten and third grade control groups were set aside and work with the kindergarten and third grade practice groups only ensued.

In order to ascertain valid and reliable data, a definite practice procedure had to be inaugurated for use with both practice groups. A daily practice period of thirty minutes duration was given to each Practice Group for a ten day period. The practice was given these groups through the medium of the game of Hop-scotch.

A large portable hop-scotch board was constructed. The digits on the face of the board were easily read because of the contrast between the color of the digits and the background. The division of space for each digit was made large enough to accommodate an average adult's shoe. The game had definite directions and rules. In the beginning of each practice period the E said:

"Boys and girls we are going to play a new type of hop-scotch. In order to help your team win, you must be very quiet and allow only the one whose turn it is to talk. We must remember this for we will have to take off one point for everyone who talks out of turn. Here is our hop-scotch board. These are the other rules of the game:

I will say some numbers and when I get through you say them just the

way I did while you are blindfolded. Then if you say them correctly, you will be unblindfolded and allowed to hop-scotch the board. You throw this disc on one of your numbers on the hop-scotch board. If it hits anywhere inside the line of the space for the digit that number is free. In other words, you do not have to hop-scotch that number. However, you must hop-scotch all the other numbers in the order given. The winning team will be the one who has the greatest number of people who could successfully repeat the digits and hop scotch the digits. You may start any place on the hop-scotch, but you must hop-scotch in the correct sequence in which the digits were given to you. Let's practice a few times before we actually start the game: . . . . . O.K. Does everyone understand and are we ready? Fine, let's begin!"

The children were seated upon comfortable chairs on either side of the hop-scotch board. Each child, when it was his turn was blindfolded and asked to repeat the series of digits which he could successfully repeat. The series for each child was determined from the results of the Pre-test. Gradually during ensuing practice periods, each child was paced to the next more difficult series up to the point of his maximum individual development or capacity. If the child was successful in the repetition of the digits, the blindfold was removed and he had to hop-scotch the board in the same sequence as the digits were given to him. As was indicated earlier in this paragraph the children were seated along each side of the hop-scotch board in such a position that the S's attention was focused upon the digits appear-

ing upon the face of the board. This was done in order to give as many varied methods of practice as possible.

In this manner, every child's auditory perception of digits was re-enforced through visual perception of the digits as well as through the kin-aesthetic approach of the hop-scotch board.

Another aspect which ought to be mentioned is the following: The position of every child rotated daily. The child who was first in team position Monday would be second on Tuesday, third on Wednesday and so on. However, may it be stressed that although position within the team rotated daily, members within the team remained constant throughout the ten days of practice. On the tenth day of practice a notation was made on an individual score sheet of the practice score obtained by every individual member of both the kindergarten and third grade practice group. These scores were recorded and tabulated.

A thirty day interval was allowed to lapse during which time series of digits were not even mentioned. At the end of this interval of time, a Re-test was given to all members of the kindergarten practice and control groups and to all members of the third grade practice and control groups. As was indicated earlier, the Re-test was administered individually, and individual score sheets were used to tabulate the results immediately. These results were recorded.

At this point in the study we had gathered test scores for forty-six subjects on the pre-test and the Re-test. We also had available the practice score obtained on the tenth day of practice for the twenty-three

subjects equated to the Practice Groups. An investigation and analysis of the results of the data obtained in order to ascertain the findings and conclusions indicated by this study was the final step in the procedure adopted. The following chapters will give an account of the results of the above procedure and state the main findings and conclusions of this study.

## CHAPTER V

From Table I it is evident that there was a significant immediate gain due to practice shown by the children in both groups. The Kindergarten Practice Group obtained a score of 5.11 on the tenth day of practice. This was an increase of 1.59 over their mean Pre-test Score, (3.52); which represents a gain of 45% over the Pre-test Score.

The Third Grade Practice Group obtained a score of 6.51 on the tenth day of practice, a gain of 1.15 over their Mean Pre-Test Score, 5.36; which represents a gain of 21% over the Pre-test Score.

It is also apparent from Table I that the Kindergarten Practice Group had a greater increase in scores on the tenth day of practice (an increase of 1.59 in score, or 45%) than did the Third Grade Practice Group (an increase of 1.15 in score, or 21%). This difference in gain may be due to chance, however, since the critical ratio of the difference between mean gains is 1.63, which is significant only at the 13% level of confidence.

It may be concluded from this that practice may have a different effect on the immediate span of retention for children in Kindergarten than for children in the Third Grade. It should be noticed, however, that this large percentage of gain on the part of the Kindergarten Practice Group may be due to the fact that the initial scores of this group were much lower. Again perhaps the added interest in games was a greater motivating factor for the



### Kindergarten Group.

In addition to this, Table I indicates that after a forty day interval the Kindergarten Practice Group still showed an average gain of 26% over their Mean Pre-test Score. The Kindergarten Control Group showed a gain of 3.1% over their Mean Pre-test Score at the end of the forty day period. It seems probable then, that 23% of the gain made by the Kindergarten Practice Group was due to practice; the other 3% may have been due to maturation or other factors.

A similar conclusion may be derived in regard to the Third Grade children. Table I indicates that the Third Grade Practice Group still showed an average gain of 15% over their Mean Pre-test Score at the end of the forty day period. It seems probable, then that 9% of the gain made by the Third Grade Practice Group was due to practice; a 6% gain was due to maturation.

It may be concluded from these data that the gains made by the Kindergarten children were due relatively more to practice 23% than to growth and other factors (26%:3%) than the gains made by the Third Grade Children (13%:6%).

It is therefore apparent that the K children showed much more learning and much less maturation than the children in the Third Grade. This is shown by computing the ratios of percentage learned to percentage matured for both groups. The ratio for the K is 8.7. The ratio for the third grade is 2.5.

Furthermore, it may be noted from Table I that although the Kindergarten Practice Group at the end of ten days practice made significantly greater gains (45%) than did the Third Grade Practice Group (21%), the amount of loss from the score after ten days practice for the Kindergarten Practice Group after a thirty day interval with no practice was larger (15%) than the amount of loss from the score after ten days practice for the Third Grade Practice Group after the same interval (5%) (Col. 6 & 9). This may be a chance difference, however as the critical ratio of the difference between the mean losses is 1.43, which is significant only at the 17% level of confidence.

From these data it may be concluded that although the Kindergarten children showed a far greater gain immediately after practice, they probably did not retain as much of their gain over the thirty day interval with no practice as did the Third Grade Children. The Kindergarten Children retained 87% of their gain from the ten days of practice. The Third Grade Children retained 95% of their gain from the ten days of practice. Practice, therefore, may have a greater effect upon immediate improvement for the younger age group, but a greater effect upon permanence of retention for the older age group.

TABLE I

<u>KINDERGARTEN CONTROL GROUP</u>	<u>SCORE ON PRE-TEST</u>	<u>SCORE ON RE-TEST</u>	<u>KINDERGARTEN PRACTICE GROUP</u>	<u>SCORE ON PRE-TEST</u>	<u>SCORE ON TENTH DAY OF PRACTICE</u>	<u>SCORE ON RE-TEST</u>
Ty M	2-2	2-3	Bn M	2-2	5-2	3-2
Jm S	3-2	3-1	Hy F	3-2	6-2	4-2
Cl D	3-3	3-3	Pl M	3-3	5-3	5-3
Rd B	3-3	3-3	Ge V	3-3	4-3	5-3
Le C	4-1	4-1	Rr V	4-1	5-2	4-1
Fk S	4-1	4-1	Wm S	4-1	3-3	4-1
Je T	4-2	4-2	Rd P	4-2	5-2	5-2
Jt S	4-2	4-3	Jy H	4-2	6-2	5-2
Jy B	4-3	4-3	Mn F	4-3	5-2	5-3
Cn C	4-3	4-3	Ny M	4-3	7-3	6-2
Cn H	5-1	5-3	Pa M	5-1	7-2	5-2
Ny S	6-2	6-3	Jy B	6-2	6-2	6-2

TABLE II

<u>THIRD GRADE CONTROL GROUP</u>	<u>SCORE ON PRE-TEST</u>	<u>SCORE ON RE-TEST</u>	<u>THIRD GRADE PRACTICE GROUP</u>	<u>SCORE ON PRE-TEST</u>	<u>SCORE ON 10TH DAY OF PRACTICE</u>	<u>SCORE ON RE-TEST</u>
Ge B	3-2	3-3	By B	3-2	5-2	4-3
We S	5-2	6-1	Mn S	5-2	7-2	6-2
Ra B	5-2	5-3	Cl C	5-2	6-3	6-3
Jy V	5-3	6-1	G1 K	5-3	7-2	6-2
Pl L	6-1	6-1	Jh O	6-1	7-1	7-1
Mn S	6-2	6-3	Rt P	6-2	7-1	7-1
Cl S	6-2	6-2	Je P	6-2	7-2	7-2
Ty S	6-3	7-1	Le P	6-3	6-2	6-2
Je P	7-1	7-2	Jh S	7-1	7-3	7-3
Jn S	7-1	7-2	Jn G	7-1	8-2	8-1
Ed K	7-2	8-1	Ls K	7-2	8-3	8-1

GRADE	Col. I	Col. II	Col. III	Col. IV	Col. V	Col. VI	Col. VII	Col. VIII	Col. IX	Col. X
	Number of Subjects	Pre-test Mean Score	Mean score on 10th day of Practice	Mean Score on Re-test after 40 dys.	Improvement due to 10 dys. Practice	Mean Increase in score on 10th day of Practice	Mean losses from score on 10th day of Practice	Gain over Pre-test score after 40 dys.	Loss from Practice score- Col.III after 30 dys.- Col.IV	Net retention after 40 dys.- Cols.III and IV
Kinder- garten Practice Group	12	3.52	5.11	4.44	45%	1.59	.67	26%	13%	87%
Control Group	12	3.52		3.63				3.1%		
Third Grade Practice Group	11	5.36	6.51	6.18	21%	1.15	.33	15%	5%	95%
Control Group	11	5.36		5.69				6%		

## CHAPTER VI

### CONCLUSIONS

As the problem was formulated in the beginning of this investigation, it read: Does practice have a different effect upon the span of retention in children at different age levels?

From a careful analysis of the data obtained by statistical treatment of the results no general conclusions can be made on the question of whether practice has a greater effect upon the span of retention over a long period of time for the older children than it does for the younger children.

However, the following specific conclusions may be formulated:

1. Practice tends to show a different effect upon the immediate span of retention for children in kindergarten than for children in the third grade.
2. The gains made by the kindergarten children seem to be due relatively more to practice than to other factors while the gains made by the third grade children seem to be caused to a greater extent by other factors including maturity, and habituation to concentrated attention.
3. Although the kindergarten children showed a far greater gain immediately after practice, they probably did not retain as much of their gain over the following thirty day interval during which there was no practice as did the third grade children.

The study of the effect of practice on the span of retention in children is an area relatively unexplored. There is a pronounced lack of data published in the journals. Our Educational Psychology today is still in a developmental state. Scientific findings are constantly being increased and there is a continual attempt to use all possible resources in the educational process. In view of these considerations a more extensive study of this problem would seem to be necessary.

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APPROVAL SHEET

The thesis submitted by Kathleen E. O'Brien has been read and approved by three members of the Department of Psychology.

The final copies have been examined by the director of the thesis and the signature which appears below verifies the fact that any necessary changes have been incorporated, and that the thesis is now given final approval with reference to content, form, and mechanical accuracy.

The thesis is therefore accepted in partial fulfillment of the requirements for the Degree of Master of Arts.

Jan. 18, 1949  
Date

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